ANNALS OF BOTANY

Founded 1887

Volume 70 (July to December) 1992

C.A.B. INTERNATIONAL INSTITUTE OF PARASITOLOGY
395A, HATFIELD ROAD,
ST. ALBANS,
HERTS. AL4 0XU
U.K.

Academic Press

Harcourt Brace Jovanovich, Publishers

London San Diego New York Boston Sydney Tokyo Toronto

Copyright © 1992 Annals of Botany
ALL RIGHTS RESERVED
No part of this volume may be reproduced in any form, by photostat, microfilm or any other means, without written permission from the publishers
ISSN 0305-7364

CONTENTS

Volume 70

Number 1 **July 1992**

Editorial 1

Kumar, A. and Elston, J. Genotypic Differences in Leaf Water Relations Between *Brassica juncea* and *B. napus* 3

Kjær, S. Biological Nitrogen Fixation in *Pachyrhizus ahipa* (Wedd.) Parodi 11

Smith, G. S., Clark, C. J. and Boldingh, H. L. Seasonal Accumulation of Starch by Components of the Kiwifruit Vine 19

Vos, J. and Biemond, H. Effects of Nitrogen on the Development and Growth of the Potato Plant. 1. Leaf Appearance, Expansion Growth, Life Spans of Leaves and Stem Branching 27

Biemond, H. and Vos, J. Effects of Nitrogen on the Development and Growth of the Potato Plant. 2. The Partitioning of Dry Matter, Nitrogen and Nitrate 37

Beckett, R. P. and van Staden, J. The Effect of Thidiazuron on the Yield of Salinity Stressed Wheat 47

Ekanayake, I. J. and de Jong, J. P. Stomatal Response of Some Cultivated and Wild Tuber-bearing Potatoes in Warm Tropics as Influenced by Water Deficits 53

Khan, M. A. Seed-protein Electrophoretic Pattern in *Brachypodium* P. Beauv. Species 61

Gibson D., Casal, J. J. and Deregibus, V. A. The Effects of Plant Density on Shoot and Leaf Lamina Angles in *Lolium multiflorum* and *Paspalum dilatatum* 69

Farrant, J. M., Pammenter, N. W. and Berjak, P. Development of the Recalcitrant (Homoiohydrous) Seeds of *Avicennia marina*: Anatomical, Ultrastructural and Biochemical Events Associated with Development from Histodifferentiation to Maturation 75

Ellis, R. H., Collinson, S. T., Hudson, D. and Patefield, W. M. The Analysis of Reciprocal Transfer Experiments to Estimate the Durations of the Photoperiod-sensitive and Photoperiod-insensitive Phases of Plant Development: An Example in Soya Bean 87

Béranger-Novat, N. and Dawidowicz-Grzegorzewska, A. Effect of Gibberellin on Mature *Euonymus europaeus* L. Seeds 93

Book Reviews 101

Number 2 **August 1992**

Jaramillo-C. G., White, J. W. and De La Cruz-A. G. The Effect of Soil Compaction on Differentiation of Late Metaxylem in Common Bean (*Phaseolus vulgaris* L.) 105

Bennett, S. T. and Bennett, M. D. Spatial Separation of Ancestral Genomes in the Wild Grass *Milium montianum* Parl. 111

Dubois, T., Dubois, J., Guedira, M., Diop, A. and Vasseur, J. SEM Characterization of an Extracellular Matrix Around Somatic Proembryos in Roots of *Cichorium* 119

Kiel, C. and Stamp, P. Internal Root Anatomy of Maize Seedlings (*Zea mays* L.) as Influenced by Temperature and Genotype 125
Robberecht, R. and Junttila, O. The Freezing Response of an Arctic Cushion Plant, *Saxifraga Caespitosa* L.: Acclimation, Freezing Tolerance and Ice Nucleation 129
Thornley, J. H. M. and Cannell, M. G. R. Nitrogen Relations in a Forest Plantation—Soil Organic Matter Ecosystem Model 137
Kantharajah, A. S., McConchie, C. A. and Dodd, W. A. *In Vitro* Embryo Culture and Induction of Multiple Shoots in Lychee (*Litchi chinensis* Sonn.) 153
Morrison, D. A., Auld, T. D., Rish, S., Porter, C. and McClay, K. Patterns of Testa-imposed Seed Dormancy in Native Australian Legumes 157
Martín, C. and Pérez, C. Multiplication *In Vitro* of *Limonium estevei* Fdez. Casas 165
Barnett, J. R. Reactivation of the Cambium in *Aesculus hippocastanum* L.: Transmission Electron Microscope Study 169
Pacini, E., Taylor, P. E., Singh, M. B. and Knox, R. B. Development of Plastids in Pollen and Tapetum of Rye-grass, *Lolium perenne* L. 179
Gould, K. S., Young, J. P. W. and Cutter, E. G. L-System Analysis of Compound Leaf Development in *Pisum sativum* L. 189
Book Reviews 197

Number 3 **September 1992**

Bellarosa, R., Håkan Mo, L. and Von Arnold, S. The Influence of Auxin and Cytokinin on Proliferation and Morphology of Somatic Embryos of *Picea abies* (L.) Karst. 199
Iijima, M. and Kono, Y. Development of Golgi Apparatus in the Root Cap Cells of Maize (*Zea mays* L.) as Affected by Compacted Soil 207
Ryle, G. J. A., Woledge, J., Tewson, V. and Powell, C. E. Influence of Elevated CO_2 and Temperature on the Photosynthesis and Respiration of White Clover Dependent on N_2 Fixation 213
Ryle, G. J. A., Powell, C. E. and Davidson, I. A. Growth of White Clover, Dependent on N_2 Fixation, in Elevated CO_2 and Temperature 221
Clark, C. J. and Smith, G. S. Seasonal Dynamics of Biomass and Mineral Nutrient Partitioning in Mature Kiwifruit Vines 229
Bélanger, G., Gastal, F. and Warembourg, F. R. The Effects of Nitrogen Fertilization and the Growing Season on Carbon Partitioning in a Sward of Tall Fescue (*Festuca arundinacea* Schreb) 239
Radoglou, K. M. and Jarvis, P. G. The Effects of CO_2 Enrichment and Nutrient Supply on Growth Morphology and Anatomy of *Phaseolus vulgaris* L. Seedlings 245
Radoglou, K. M., Aphalo, P. and Jarvis, P. G. Response of Photosynthesis, Stomatal Conductance and Water Use Efficiency to Elevated CO_2 and Nutrient Supply in Acclimated Seedlings of *Phaseolus vulgaris* L. 257
Smith, G. S., Curtis, J. P. and Edwards, C. M. A Method for Analysing Plant Architecture as it Relates to Fruit Quality Using Three-dimensional Computer Graphics 265

Andrews, M., Morton, J. D., Lieffering, M. and Bisset, L. The Partitioning of Nitrate Assimilation Between Root and Shoot of a Range of Temperate Cereals and Pasture Grasses 271
Ma, Y. and Steeves, T. A. Auxin Effects on Vascular Differentiation in Ostrich Fern 277
Minchin, F. R., Iannetta, P. P. M., Fernandez-Pascual, M., De Lorenzo, C., Witty, J. F. and Sprent, J. I. A New Procedure for the Calculation of Oxygen Diffusion Resistance in Legume Nodules from Flow-through Gas Analysis Data 283
Book Reviews 291

Number 4 **October 1992**
Sharma, S. S., Sharma, S. and Rai, V. K. The Effect of EGTA, Calcium Channel Blockers (Lanthanum Chloride and Nifedipine) and Their Interaction with Abscisic Acid on Seed Germination of *Brassica juncea* cv. RLM-198 295
Malik, K. A., Ali Khan, S. T. and Saxena, P. K. Direct Organogenesis and Plant Regeneration in Preconditioned Tissue Cultures of *Lathyrus cicera* L., *L. ochrus* (L.) DC. and *L. sativus* L. 301
Yokozawa, M. and Hara, T. A Canopy Photosynthesis Model for the Dynamics of Size Structure and Self-thinning in Plant Populations 305
Mauseth, J. D. and Sajeva, M. Cortical Bundles in the Persistent, Photosynthetic Stems of Cacti 317
Figueiredo, A. C. S. and Pais, M. S. Ultrastructural Aspects of the Nectary Spur of *Limodorum abortivum* (L.) Sw. (Orchidaceae) 325
Eagles, C. F. and Williams, J. Hardening and Dehardening of *Lolium perenne* in Response to Fluctuating Temperatures 333
Collinson, S. T., Ellis, R. H., Summerfield, R. J. and Roberts, E. H. Durations of the Photoperiod-sensitive and Photoperiod-insensitive Phases of Development to Flowering in Four Cultivars of Rice (*Oryza sativa* L.) 339
Niklas, K. J. Voigt and Reuss Models for Predicting Changes in Young's Modulus of Dehydrating Plant Organs 347
MacDonald, M. V. Donor Plant Growth Factors Affecting Anther Culture of Maize and Sweetcorn (*Zea mays*) 357
Pilbeam, C. J. Effect of Nitrogen Supply on the Growth and Senescence of Leaves of *Lolium perenne* with Contrasting Rates of Leaf Respiration 365
Dick, J. McP. and Dewar, R. C. A Mechanistic Model of Carbohydrate Dynamics During Adventitious Root Development in Leafy Cuttings 371
Lev-Yadun, S. and Aloni, R. Experimental Induction of Dilatation Meristems in *Melia azedarach* L. 379
Book Reviews 387

Number 5 **November 1992**
Zer, H. and Fahn, A. Floral Nectaries of *Rosmarinus officinalis* L. Structure, Ultrastructure and Nectar Secretion 391

Serrato Valenti, G., Melone, L., Orsi, O. and Riveros, F. Anatomical Changes in *Prosopis cineraria* (L.) Druce Seedlings Growing at Different Levels of NaCl Salinity 399
DeCássia L. Figueiredo-Ribeiro, R., Isejima, E. M., Campos Dietrich, S. M. and Chaves Corrêa, J. B. Hemicellulosic Polysaccharides from the Xylopodium of *Ocimum nudicaule*: Changes in Composition in Dormancy and Sprouting 405
Chalker-Scott, L. Disruption of an Ice-nucleation Barrier in Cold Hardy *Azalea* Buds by Sublethal Heat Stress 409
Mathur, J. *In Vitro* Morphogenesis in *Nardostachys jatamansi* DC.: Shoot Regeneration from Callus Derived Roots 419
Zobel, A. M. and Hrazdina, G. Chalcone Synthase Localization in Shoot Apices of *Fagopyrum*, *Brassica* and *Pisum* 423
LeMaire, G., Khaity, M., Onillon, B., Allirand, J. M., Chartier, M. and Gosse, G. Dynamics of Accumulation and Partitioning of N in Leaves, Stems and Roots of Lucerne (*Medicago sativa* L.) in a Dense Canopy 429
Gastal, F., Belanger, G. and LeMaire, G. A Model of the Leaf Extension Rate of Tall Fescue in Response to Nitrogen and Temperature 437
Taru Roy, A. and De, D. N. Studies on Differentiation of Laticifers Through Light and Electron Microscopy in *Calotropis gigantea* (Linn.) R. Br. 443
Kohyama, T. Density-size Dynamics of Trees Simulated by a One-sided Competition Multi-species Model of Rain Forest Stands 451
Paolillo, D. J. Jr. and Sorrells, M. E. The Spatial Distribution of Growth in the Extension Zone of Seedling Wheat Leaves 461
Johri, B. M. Haustorial Role of Pollen Tubes 471
Dornelas, M. C., Vieira, M. L. C. and Appezzato-Da-Gloria, B. Histological Analysis of Organogenesis and Somatic Embryogenesis Induced in Immature Tissues of *Stylosanthes scabra* 477

Number 6 December 1992
Nobel, P. S. and Cui, M. Shrinkage of Attached Roots of *Opuntia ficus-indica* in Response to Lowered Water Potentials—Predicted Consequences for Water Uptake or Loss to Soil 485
Skinner, R. H. and Nelson, C. J. Estimation of Potential Tiller Production and Site Usage During Tall Fescue Canopy Development 493
Dschida, W. J., Platt-Aloia, K. A. and Thomson, W. W. Epidermal Peels of *Avicennia germinans* (L.) Stearn: A Useful System to Study the Function of Salt Glands 501
Van Loo, E. N. Tillering, Leaf Expansion and Growth of Plants of Two Cultivars of Perennial Ryegrass Grown Using Hydroponics at Two Water Potentials 511
Goode, J. A., Duckett, J. G. and Stead, A. D. Protonemal Morphogenesis of the Moss *Tetraphis pellucida* Hedw. in Culture and in the Wild 519
Romano, A., Noronha, C. and Martins-Loução, M. A. Influence of Growth Regulators on Shoot Proliferation in *Quercus suber* L. 531
Koops, A. J. and Groeneveld, H. W. Unsaponifiable Lipid Biosynthesis in

the Seedling of *Euphorbia lathyris* L.: A Bypass via Alcoholic Fermentation 537
Frensch, J., Stelzer, R. and Steudle, E. NaCl Uptake in the Roots of *Zea mays* Seedlings: Comparison of Root Pressure Probe and EDX Data 543
Luo, Y. and Nobel, P. S. Carbohydrate Partitioning and Compartmental Analysis for a Highly Productive CAM Plant, *Opuntia ficus-indica* 551
Gao, X., Francis, D., Ormrod, J. C. and Bennett, M. D. An Electron Microscopic Study of Double Fertilization in Allohexaploid Wheat *Triticum aestivum* L. 561
Dickinson, N. M., Turner, A. P., Watmough, S. A. and Lepp, N. W. Acclimation of Trees to Pollution Stress: Cellular Metal Tolerance Traits 569
Weber, M. The Formation of Pollenkitt in *Apium nodiflorum* (Apiaceae) 573
Book Reviews 579

Author Index

Ali Khan, S. T. (see Malik, K. A.), 301
Allirand, J. M. (see Lemaire, G.), 429
Aloni, R. (see Lev-Yadun, S.), 379
Andrews, M., Morton, J. D., Lieffering, M. & Bisset, L., The partitioning of nitrate assimilation between root and shoot of a range of temperate cereals and pasture grasses, 271
Aphalo, P. (see Radoglou, K. M.), 257
Appezzato-da-Gloria, B. (see Dornelas, M. C.), 477
Auld, T. D. (see Morrison, D. A.), 157
Barnett, J. R., Reactivation of the cambium in *Aesculus hippocastanum* L.: a transmission electron microscope study, 169
Beckett, R. P. & Van Staden, J., The effect of thidiazuron on the yield of salinity stressed wheat, 47
Bélanger, G., Gastal, F. & Warembourg, F. R., The effects of nitrogen fertilization and the growing season on carbon partitioning in a sward of tall fescue (*Festuca arundinacea* Schreb.), 239
Belanger, G. (see Gastal, F.), 437
Bellarosa, R., Håkan Mo, L. & Von Arnold, S., The influence of auxin and cytokinin on proliferation and morphology of somatic embryos of *Picea abies* (L.) Karst, 199
Bennett, M. D. (see Bennett, S. T.), 111
——, (see Gao, X.), 561
Bennett, S. T. & Bennett, M. D., Spatial separation of ancestral genome in the wild grass *Milium montianum* Parl., 111
Béranger-Novat, N. & Dawidowicz-Grzegorzewska, A., Effect of gibberellin on mature *Euonymus europaeus* L. seeds, 93
Berjak, P. (see Farrant, J. M.), 75
Biemond, H. (see Vos, J.), 27
——, Vos, J., Effects of nitrogen on the development and growth of the potato plant. 2. The partitioning of dry matter, nitrogen and nitrate, 37
Bisset, L. (see Andrews, M.), 271
Boldingh, H. L. (see Smith, G. S.), 19
Cannell, M. G. R. (see Thornley, J. H. M.), 137
Casal, J. J. (see Gibson, D.), 69
Chalker-Scott, L., Disruption of an ice-nucleation barrier in cold hardy *Azalea* buds by sublethal heat stress, 409
Chartier, M. (see Lemaire, G.), 429
Clark, C. J. (see Smith, G. S.), 19
——, Smith, G. S., Seasonal dynamics of biomass and mineral nutrient partitioning in mature kiwifruit vines, 229
Collinson, S. T. (see Ellis, R. H.), 87
——, Ellis, R. H., Summerfield, R. J., Roberts, E. H., Durations of the photoperiod-sensitive and photoperiod-insensitive phases of development to flowering in four cultivars of rice (*Oryza sativa* L.), 339
Corrêa, J. B. C. (see Figueiredo-Ribeiro, R. de C. L.), 405
Cui, M. (see Nobel, P. S.), 485
Curtis, J. P. (see Smith, G. S.), 265
Cutter, E. G. (see Gould, K. S.), 189
Davidson, I. A. (see Ryle, G. J. A.), 221
Dawidowicz-Grzegorzewska, A. (see Béranger-Novat, N.), 93
De, D. N. (see Roy, A. T.), 443
De Jong, J. P. (see Ekanayake, I. J.), 53
de la Cruz, A. G. (see Jaramillo, C. G.), 105
de Lorenzo, C. (see Minchin, F. R.), 283
Deregibus, V. A. (see Gibson, D.), 69
Dewar, R. C. (see Dick, J. McP.), 371
Dick, J. McP. & Dewar, R. C., A mechanistic model of carbohydrate dynamics during adventitious root development in leafy cuttings, 371
Dickinson, N. M., Turner, A. P., Watmough, S. A. & Lepp, N. W., Acclimation of trees to pollution stress: cellular metal tolerance traits, 569
Dietrich, S. M. C. (see Figueiredo-Ribeiro, R. de C. L.), 405
Diop, A. (see Dubois, T.), 119
Dodd, W. A. (see Kantharajah, A. S.), 153
Dornelas, M. C., Vieira, M. L. C. & Appezzato-da-Gloria, B., Histological analysis of organogenesis and somatic embryogenesis induced in immature tissues of *Stylosanthes scabra*, 477
Dschida, W. J., Platt-Aloia, K. A. & Thomson, W. W., Epidermal peels of *Avicennia germinans* (L.) Stearn: a useful system to study the function of salt glands, 501
Dubois, J. (see Dubois, T.), 119
Dubois, T., Dubois, J., Guedira, M., Diop, A. & Vasseur, J., SEM characterization of an extracellular matrix around somatic proembryos in roots of *Cichorium*, 119
Duckett, J. G. (see Goode, J. A.), 519
Eagles, C. F. & Williams, J., Hardening and dehardening of *Lolium perenne* in response to fluctuating temperatures, 333
Edwards, C. M. (see Smith, G. S.), 265
Ekanayake, I. J. & De Jong, J. P., Stomatal response of some cultivated and wild tuber-bearing potatoes in warm tropics as influenced by water deficits, 53
Ellis, R. H., Collinson, S. T., Hudson, D. & Patefield, W. M., The analysis of reciprocal transfer experiments to estimate the durations of the photoperiod-sensitive and photoperiod-insensitive phases of plant development: an example in soya bean, 87
——, (see Collinson, S. T.), 339

Elston, J. (see Kumar, A.), 3
Fahn, A. (see Zer, H.), 391
Farrant, J. M., Pammenter, N. W. & Berjak, P., Development of the recalcitrant (homoiohydrous) seeds of *Avicennia marina*: anatomical, ultrastructural and biochemical events associated with development from histodifferentiation to maturation, 75
Fernandez-Pascual, M. (see Minchin, F. R.), 283
Figueiredo, A. C. S. & Salomé Pais, M., Ultrastructural aspects of the nectary spur of *Limodorum abortivum* (L) Sw. (Orchidaceae), 325
Figueiredo-Ribeiro, R. de C. L., Mitiko Isejima, E., Dietrich, S. M. C. & Corrêa, J. B. C., Hemicellulosic polysaccharides from the xylopdium of *Ocimum nudicaule*: changes in composition in dormancy and sprouting, 405
Francis, D. (see Gao, X.), 561
Frensch, J., Stelzer, R. & Steudle, E., NaCl uptake in roots of *Zea mays* seedlings: comparison of root pressure probe and EDX data, 543
Gao, X., Francis, D., Ormrod, J. C. & Bennett, M. D., An electron microscopic study of double fertilization in allohexaploid wheat *Triticum aestivum* L., 561
Gastal, F. (see Bélanger, G.), 239
——, Belanger, G., Lemaire, G., A model of the leaf extension rate of tall fescue in response to nitrogen and temperature, 437
Gibson, D., Casal, J. J. & Deregibus, V. A., The effects of plant density on shoot and leaf lamina angles in *Lolium multiflorum* and *Paspalum dilatatum*, 69
Goode, J. A., Duckett, J. G. & Stead, A. D., Protonemal morphogenesis of the moss *Tetraphis pellucida* Hedw. in culture and in the wild, 519
Gosse, G. (see Lemaire, G.), 429
Gould, K. S., Young, J. P. W. & Cutter, E. G., L-system analysis of compound leaf development in *Pisum sativum* L., 189
Groeneveld, H. W. (see Koops, A. J.), 537
Guedira, M. (see Dubois, T.), 119
Håkan Mo, L. (see Bellarosa, R.), 199
Hara, T. (see Yokozawa, M.), 305
Hrazdina, G. (see Zobel, A. M.), 423
Hudson, D. (see Ellis, R. H.), 87
Hunt, R., Editorial, 1
Iannetta, P. P. M. (see Minchin, F. R.), 283
Iijima, M. & Kono, Y., Development of Golgi apparatus in the root cap cells of maize (*Zea mays* L.) as affected by compacted soil, 207
Jaramillo, C. G., White, J. W. & de la Cruz, A. G., The effect of soil compaction on differentiation of late metaxylem in common bean (*Phaseolus vulgaris* L.), 105
Jarvis, P. G. (see Radoglou, K. M.), 245, 257
Johri, B. M., Haustorial role of pollen tubes, 471
Junttila, O. (see Robberecht, R.), 129
Kantharajah, A. S., McConchie, C. A. & Dodd, W. A., *In vitro* embryo culture and induction of multiple shoots in lychee (*Litchi chinensis* Sonn.), 153
Khaity, M. (see Lemaire, G.), 429
Khan, M. A., Seed-protein electrophoretic pattern in *Brachypodium* P. Beauv. species, 61
Kiel, C. & Stamp, P., Internal root anatomy of maize seedlings (*Zea mays* L.) as influenced by temperature and genotype, 125
Kjær, S., Biological nitrogen fixation in *Pachyrhizus ahipa* (Wedd.) Parodi, 11
Knox, R. B. (see Pacini, E.), 179
Kohyama, T., Density-size dynamics of trees simulated by a one-sided competition multi-species model of rain forest stands, 451
Kono, Y. (see Iijima, M.), 207
Koops, A. J. & Groeneveld, H. W., Unsaponifiable lipid biosynthesis in the seedling of *Euphorbia lathyris* L.: a bypass via alcoholic fermentation, 537
Kumar, A. & Elston, J., Genotypic differences in leaf water relations between *Brassica juncea* and *B. napus*, 3
Lemaire, G., Khaity, M., Onillon, B., Allirand, J. M., Chartier, M. & Gosse, G., Dynamics of accumulation and partitioning of N in leaves, stems and roots of lucerne (*Medicago sativa* L.) in a dense canopy, 429
——, (see Gastal, F.), 437
Lepp, N. W. (see Dickinson, N. M.), 569
Lev-Yadun, S. & Aloni, R., Experimental induction of dilatation meristems in *Melia azedarach* L., 379
Lieffering, M. (see Andrews, M.), 271
Luo, Y. & Nobel, P. S., Carbohydrate partitioning and compartmental analysis for a highly productive CAM plant, *Opuntia ficus-indica*, 551
Ma, Y. & Steeves, T. A., Auxin effects on vascular differentiation in ostrich fern, 277
MacDonald, M. V., Donor plant growth factors affecting anther culture of maize and sweetcorn, 357
Malik, K. A., Ali Khan, S. T. & Saxena, P. K., Direct organogenesis and plant regeneration in preconditioned tissue cultures of *Lathyrus cicera* L., *L. ochrus* (L.)DC. and *L. sativus* L., 301
Martín, C. & Pérez, C., Multiplication *in vitro* of *Limonium estevei* Fdez. Casas, 165
Martins-Loução, M. A. (see Romano, A.), 531
Mathur, J., *In vitro* morphogenesis in *Nardostachys jatamansi* DC.: shoot regeneration from callus derived roots, 419
Mauseth, J. D. & Sajeva, M., Cortical bundles in the persistent, photosynthetic stems of cacti, 317
McClay, K. (see Morrison, D. A.), 157
McConchie, C. A. (see Kantharajah, A. S.), 153
Melone, L. (see Serrato Valenti, G.), 399
Minchin, F. R., Iannetta, P. P. M., Fernandez-Pascual, M., de Lorenzo, C., Witty, J. F. & Sprent, J. I., A new procedure for the calculation of oxygen diffusion resistance in legume nodules from flow-through gas analysis data, 283
Mitiko Isejima, E. (see Figueiredo-Ribeiro, R. de C. L.), 405
Morrison, D. A., Auld, T. D., Rish, S., Porter, C. & McClay, K., Patterns of testa-imposed seed dormancy in native Australian legumes, 157
Morton, J. D. (see Andrews, M.), 271
Nelson, C. J. (see Skinner, R. H.), 493
Niklas, K. J., Voigt and Reuss models for predicting changes in Young's modulus of dehydrating plant organs, 347
Nobel, P. S. & Cui, M., Shrinkage of attached roots of *Opuntia ficus-indica* in response to lowered water potentials—predicted consequences for water uptake or loss to soil, 485
——, (see Luo, Y.), 551
Noronha, C. (see Romano, A.), 531

Onillon, B. (see Lemaire, G.), 429
Ormrod, J. C. (see Gao, X.), 561
Orsi, O. (see Serrato Valenti, G.), 399
Pacini, E., Taylor, P. E., Singh, M. B. & Knox, R. B., Development of plastids in pollen and tapetum of rye-grass, *Lolium perenne* L., 179
Pammenter, N. W. (see Farrant, J. M.), 75
Paolillo, D. J. Jr & Sorrells, M. E., The spatial distribution of growth in the extension zone of seedling wheat leaves, 461
Patefield, W. M. (see Ellis, R. H.), 87
Pérez, C. (see Martín, C.), 165
Pilbeam, C. J., Effect of nitrogen supply on the growth and senescence of leaves of *Lolium perenne* with contrasting rates of leaf respiration, 365
Platt-Aloia, K. A. (see Dschida, W. J.), 501
Porter, C. (see Morrison, D. A.), 157
Powell, C. E. (see Ryle, G. J. A.), 213, 221
Radoglou, K. M. & Jarvis, P. G., The effects of CO_2 enrichment and nutrient supply on growth morphology and anatomy of *Phaseolus vulgaris* L. seedlings, 245
——, Aphalo, P., Jarvis, P. G., Response of photosynthesis, stomatal conductance and water use efficiency to elevated CO_2 and nutrient supply in acclimated seedlings of *Phaseolus vulgaris* L., 257
Rai, V. K. (see Sharma, S. S.), 295
Rish, S. (see Morrison, D. A.), 157
Riveros, F. (see Serrato Valenti, G.), 399
Robberecht, R. & Junttila, O., The freezing response of an arctic cushion plant, *Saxifraga caespitosa* L.: acclimation, freezing tolerance and ice nucleation, 129
Roberts, E. H. (see Collinson, S. T.), 339
Romano, A., Noronha, C. & Martins-Loução, M. A., Influence of growth regulators on shoot proliferation in *Quercus suber* L., 531
Roy, A. T. & De, D. N., Studies on differentiation of laticifers through light and electron microscopy in *Calotropis gigantea* (Linn.) R.Br., 443
Ryle, G. J. A., Woledge, J., Tewson, V. & Powell, C. E., Influence of elevated CO_2 and temperature on the photosynthesis and respiration of white clover dependent on N_2 fixation, 213
——, Powell, C. E., Davidson, I. A., Growth of white clover, dependent on N_2 fixation, in elevated CO_2 and temperature, 221
Sajeva, M. (see Mauseth, J. D.), 317
Salomé Pais, M. (see Figueiredo, A. C. S.), 325
Saxena, P. K. (see Malik, K. A.), 301
Serrato Valenti, G., Melone, L., Orsi, O. & Riveros, F., Anatomical changes in *Prosopis cineraria* (L.) Druce seedlings growing at different levels of NaCl salinity, 399
Sharma, S. (see Sharma, S. S.), 295
Sharma, S. S., Sharma, S. & Rai, V. K., The effect of EGTA, calcium channel blockers (lanthanum chloride and nifedipine) and their interaction with abscisic acid on seed germination of *Brassica juncea* cv. RLM-198, 295
Singh, M. B. (see Pacini, E.), 179
Skinner, R. H. & Nelson, C. J., Estimation of potential tiller production and site usage during tall fescue canopy development, 493
Smith, G. S., Clark, C. J. & Boldingh, H. L., Seasonal accumulation of starch by components of the kiwifruit vine, 19
——, (see Clark, C. J.), 229
——, Curtis, J. P., Edwards, C. M., A method for analysing plant architecture as it relates to fruit quality using three-dimensional computer graphics, 265
Sorrells, M. E. (see Paolillo, D. J. Jr), 461
Sprent, J. I. (see Minchin, F. R.), 283
Stamp, P. (see Kiel, C.), 125
Stead, A. D. (see Goode, J. A.), 519
Steeves, T. A. (see Ma, Y.), 277
Stelzer, R. (see Frensch, J.), 543
Steudle, E. (see Frensch, J.), 543
Summerfield, R. J. (see Collinson, S. T.), 339
Taylor, P. E. (see Pacini, E.), 179
Tewson, V. (see Ryle, G. J. A.), 213
Thomson, W. W. (see Dschida, W. J.), 501
Thornley, J. H. M. & Cannell, M. G. R., Nitrogen relations in a forest plantation—soil organic matter ecosystem model, 137
Turner, A. P. (see Dickinson, N. M.), 569
Van Loo, E. N., Tillering, leaf expansion and growth of plants of two cultivars of perennial ryegrass grown using hydroponics at two water potentials, 511
Van Staden, J. (see Beckett, R. P.), 47
Vasseur, J. (see Dubois, T.), 119
Vieira, M. L. C. (see Dornelas, M. C.), 477
Von Arnold, S. (see Bellarosa, R.), 199
Vos, J. & Biemond, H., Effects of nitrogen on development and growth of the potato plant. 1. Leaf appearance, expansion growth, life spans of leaves and stem branching, 27
——, (see Biemond, H.), 37
Warembourg, F. R. (see Bélanger, G.), 239
Watmough, S. A. (see Dickinson, N. M.), 569
Weber, M., The formation of pollenkitt in *Apium nodiflorum* (Apiaceae), 573
White, J. W. (see Jaramillo, C. G.), 105
Williams, J. (see Eagles, C. F.), 333
Witty, J. F. (see Minchin, F. R.), 283
Woledge, J. (see Ryle, G. J. A.), 213
Yokozawa, M. & Hara, T., A canopy photosynthesis model for the dynamics of size structure and self-thinning in plant populations, 305
Young, J. P. W. (see Gould, K. S.), 189
Zer, H. & Fahn, A., Floral nectaries of *Rosmarinus officinalis* L. Structure, ultrastructure and nectar secretion, 391
Zobel, A. M. & Hrazdina, G., Chalcone synthase localization in shoot apices of *Fagopyrum*, *Brassica* and *Pisum*, 423

Subject Index

Abscisic acid, 295
Acclimation, 409, 569
Acer pseudoplatanus L., 569
Actinidia deliciosa, 19, 229, 265
Adventitious regeneration, 165
Aesculus hippocastanum L., 169
Ahipa, 11
Allopolyploid, 111
Amyloplasts, 179
Anatomical changes, 399
Anatomy, 75, 105
Ancestral genome separation, 111
Angiosperms, 471
Anthesis, 325
Apiaceae, 573
Apium nodiflorum L., 573
Arctic, 129
Autophagy, 179
Auxin, 199, 277, 379, 531
Avena sativa L., 271
Avicennia germinans (Avicenniaceae), 501
Avicennia marina, 75

Bark, 379
Barley, 271
Biochemistry, 75
Brachypodium P. Beauv., 61
Branching, 189
Brassica, 423
Brassica juncea, 3, 295
Brassica napus, 3
Browning, 531
Bulla, 471

Ca^{2+} channel blockers, 295
Cactaceae, 317
Calotropis gigantea (Linn.) R.Br., 443
Cambium, 169
Canopy development, 493
Canopy photosynthesis, 305
Carbohydrates, 245, 371
Carbon, 137, 239
Carbon partitioning, 551
Cell-wall storage polysaccharide, 405
Chalcone synthase, 423
Chilling tolerance, 125
Chlorophyll, 245
Chlorophyll fluorescence, 129
Cichorium, 119
CO_2 enrichment, 257
CO_2–nutrient interaction, 245
Cocksfoot, 271
Cold acclimation, 129
Cold dehardening, 333
Cold hardening, 333
Common bean, 105
Compartment model, 551
Competition, 451
Competition mode, 305
Computer graphics, 265
Continuity equation, 305
Cork-oak, 531
Cortex, 379
Cortical bundles, 317
Cushion plant, 129
Cytokinin, 199, 531

Dactylis glomerata L., 271
De novo differentiation, 301
Degenerate synergid, 561
Dehydration, 347
Density effect, 451
Dictyosome, 207, 325
Differentiation, 443
Dilatation, 379
Dinitrogen fixation, 11
Diurnal temperature fluctuations, 333
Dormancy, 169
Dormancy loss, 157
Dormant embryo, 93
Double fertilization, 561
Drought, 551
Dry matter and N partitioning, 11
Dry matter distribution, 37
Dry matter production, 37

EGTA, 295
Elaioplasts, 179, 573
Electrophoretic pattern, 61
Elevated atmospheric CO_2, 245
Elevated CO_2, 213, 221
Elevated temperature, 213, 221
Elongation, 461
Embryo culture, 153
Embryogenic cultures, 199
Embryos, 357
Endoplasmic reticulum, 325
Epicotyl, 301
ER, 573
Ethanol, 537
Ethylene, 379
Euonymus europaeus L., 93
Euphorbia lathyris, 537
Evolution, 317
Extension zone, 461
Extracellular matrix, 119
Extracellular proteins, 119

Fabaceae, 157
Faboideae, 157
Fagopyrum, 423
Fermentation, 537
Fertilization, 239, 471
Festuca arundinacea, 437
Festuca arundinacea Schreb., 239, 493
Fine structure, 93
Flowering, 87
Fluxes, 137
Foliage architecture, 69
Forest, 137
Forestry, 531
Freezing stress, 129
Freezing tolerance, 129
Fruit quality, 265

GA_3 and cold treatments, 93
Gemmae, 519
Genotypes, 125
Germination, 157
Gibberellic acid, 461

Glycine max (L.) Merrill, 87
Golgi apparatus, 207
Gramineae, 111
Grass, 239
Growth, 221
Growth analysis, 511
Gymnosperms, 471

Haploid culture, 357
Hard-seededness, 157
Haustorial role, 471
Hemicelluloses, 405
Histology, 477
Homeotic, 317
Homoiohydrous, 75
Hordeum vulgare L., 271

Ice nucleation, 129
Immunocytochemistry, 519
Immunogold labelling, 423
In vitro, 153
In vitro multiplication, 165
Ion localization, 543
Ion transport, 543
Italian ryegrass, 271

Kiwifruit, 19, 229, 265

L. ochrus (L.)DC., 301
Lathyrus cicera L., 301
Lathyrus pea, 301
Laticifers, 443
Leaf, 189
Leaf anatomy, 245
Leaf angle, 69
Leaf appearance, 493, 511
Leaf development, 27
Leaf elongation rate, 365, 493
Leaf extension, 27, 437, 511
Leaf longevity, 365
Leaf resistance, 53
Leaf senescence rate, 365
Leaf structure, 221
Leaf/stem ratio, 429
Legume seeds, 157
Leguminosae, 157
Limodorum abortivum (L) Sw., 325
Limonium estevei, 165
Litchi chinensis Sonn., 153
Lolium multiflorum Lam., 69, 271
Lolium perenne, 179, 333
Lolium perenne L., 271, 365, 511
L-systems, 189
Lychee, 153

Maize, 207, 543
Matteuccia struthiopteris, 277
Metabolic inhibitors, 501
Metal tolerance, 569
Metaxylem, 105
Microspores, 357
Milium montianum Parl., 111
Mimosoideae, 157
Mineral nutrition, 229
Mixed stand, 451
Model, 137, 371
Morphogenesis, 519
Morphology, 189
Moss, 519
Mucilage, 207
Multiple shoots, 153
Multiplication, 531

N partitioning, 429
N remobilization, 429
N uptake, 429
N_2 fixation, 213, 221
Nardostachys jatamansi, 419
Nectar secretion, 325, 391
Nectary, 391
Nectary spur, 325
Neighbour effects, 69
Net CO_2 assimilation rate, 257
Nitrate, 271
Nitrate assimilation, 271
Nitrate reductase activity, 271
Nitrogen, 137, 239, 437
Nitrogen concentration, 37
Nitrogen distribution, 37
Nitrogen fixation, 283
Nitrogen nutrition, 27, 37
Nitrogen supply, 365
Nodule, 283
Norway spruce, 199

Oat, 271
Ochrus Vetch *L. sativus* L., 301
Ocimum nudicaule, 405
Orchidaceae, 325
Organogenesis, 419, 477
Oryza sativa L., 339
Osmotic adjustment, 3
Oxygen diffusion resistance, 283

Pachyrhizus ahipa (Wedd.) Parodi, 11
Panicle emergence, 339
Panicle initiation, 339
Papilionoideae, 157
Partitioning, 239
Paspalum dilatatum Poir, 69
Pea, 189
Perennial ryegrass, 271, 511
Perennial ryegrass cv. S23, 365
Phaseolus vulgaris, 245
Phaseolus vulgaris L., 105, 257
Phenolics, 409
Phloem, 317, 391
Phospholipids, 93
Photoperiodism, 87, 339
Photosynthesis, 213
Phyllochron, 493
Picea abies (L.) Karst., 199
Pisum, 423
Pisum sativum L., 189
Plant age, 551
Plant architecture, 265
Plant density, 69
Plant speciation and evolution, 111
Plant structure, 27
Plant tissue culture, 569
Plant tissues, 347
Plantation, 137
Plastid differentiation, 179
Plastid division, 179
Plastids, 325, 573
Poaceae, 179
Pollen tube, 471
Pollenkitt, 573
Pollution, 569
Pools, 137
Population, 365, 451
Potato, 27, 37
Preconditioning with BAP, 301
Promeristem, 423
Prosopis cineraria (L.) Druce, 399

Protonema, 519

Quercus suber L., 531

Reactivation, 169
Recalcitrant, 75
Re-invigoration, 531
Re-multiplication, 531
Reproductive growth, 11
Resistance, 409
Respiration, 213, 283
Respiration rate, 365
Rht, 461
Rice, 339
Root anatomy, 125
Root-buds, 419
Root cap, 207
Root diameter, 485
Root growth, 239
Root hydraulic conductivity, 485
Root pressure, 543
Root–soil air gap, 485
Rooting, 371
Roots, 105
Rosmarinus officinalis, 391
Rye, 271
Rye-grass, 179

Salinity, 399, 543
Salinity stress, 47
Salt glands, 501
Saxifraga caespitosa L., 129
Seasonal accumulation, 229
Seasonal changes, 19
Secale cereale L., 271
Secretion, 501
Secretory activity, 207
Secretory tapetum, 573
Secretory vesicles, 207
Seed development/maturation, 75
Seed dormancy, 157
Seed germination, 295
Seedling, 399, 537
Seed-protein, 61
Self-thinning, 305, 451
Shading, 551
Shoot angle, 69
Shoot apex, 277, 423
Simulation, 305, 451
Site filling, 511
Site usage, 493
Size distribution, 305, 451
Soil compaction, 105
Soil hydraulic conductivity, 485
Soil mechanical impedance, 207
Soil organic matter, 137
Solanum chacoense, 53
Solanum jungasense, 53
Solanum raphanifolium, 53
Solanum tuberosum L., 27, 37, 53
Somatic embryogenesis, 119, 477
Somatic embryos, 199
Soya bean, 87
Spatial analysis, 265
Spatial chromosome disposition, 111
Standardization of references, 1
Starch, 245
Starch content, 19
Starch grains, 391
Starch granules, 179
Stele, 277
Stomatal conductance, 257
Stomatal density, 245
Stress, 409
Stylosanthes scabra, 477
Supercooling, 129
Sycamore, 569
Synchronization, 493

Tall fescue, 493
Temperature, 339, 437
Tetraphis pellucida, 519
Theodolite, 265
Thidiazuron, 47
Three-dimensional analysis, 265
Tiller production, 493
Tillering, 511
Tip growth, 519
Tissue elasticity, 3
Trees, 569
Trifolium repens, 213, 221
Triterpenoid biosynthesis, 537
Triticale, 271
× *Triticosecale* Wittm., 271
Triticum aestivum, 47, 561
Triticum aestivum L., 271, 461
Tuber crop, 11
Two-phase medium, 531

Ultrastructure, 75, 325, 443, 501

Varieties, 333
Vascular differentiation, 277
Vegetative propagation, 371
Vegetative reproduction, 519

Warm-temperate rain forest, 451
Water potential, 511
Water relations, 3, 543
Water use efficiency, 213, 257
Wheat, 47, 271, 461
White clover, 213, 221
Whole plant, 19
Whole-plant harvesting, 229

X-ray microanalysis, 543
Xylem, 317
Xylem sap., 271

Yield, 451
Young's modulus, 347

Zea mays, 357, 543
Zea mays L., 125, 207